VALUE ENGINEERING REPORT

Courtland Street Bridge Replacement
BRMLB-9007-00 (014)
P.I. No. 752015
Fulton County

March 23, 2011

OWNER AND DESIGN TEAM:

Georgia Department of Transportation
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EXECUTIVE SUMMARY

Executive Summary

VALUE ENGINEERING STUDY

BRMLB-9007-00 (014)
P.I. No. 752015
Fulton County
Courtland Street Bridge Replacement
March 7-10, 2011

Introduction

This report presents the results of a value engineering (VE) study conducted on the proposed design for the reconstruction of the Courtland Street Bridge in Atlanta, GA. This project was originally proposed to replace only the two spans over the CSX Railroad to provide horizontal and vertical clearances for a third set of tracks. Due to continued deterioration of the remaining portions of the existing Courtland Street Bridge and the low sufficiency rating, the project scope has been expanded to replace the entire 28 span structure. This existing bridge abuts several Georgia State University buildings and parking structures so the new bridge will have to maintain the same vertical and horizontal alignment to accommodate the many building and parking structure entrance / exit ramps and access points. The buildings are 60 feet apart and the new structure will be constructed immediately adjacent to and abutting these buildings.

Major contract work items include removal of the existing structure, bridge substructure, bridge superstructure, MSE wall construction / repair, bridge approach slabs, and resurfacing the approach roadway. The total estimated project construction cost is $14.98 million. The design is currently in the concept stage. The study took place March 7-10, 2011, at the Georgia DOT General Offices in Atlanta, GA, using a four person VE team.

This report presents the Team's recommendations and all back-up information, for consideration by the decision-makers. This **Executive Summary** includes a brief description of each recommendation. The **Study Identification** section contains information about the project and the team. The **Recommendations** section presents a more detailed description and support information about each recommendation. The **Appendix** includes a complete record of the Team's activities and findings. The reader is encouraged to review all sections of the report in order to obtain a complete understanding of the VE process.

Considerations

The VE team was presented with several constraints to consider when developing their recommendations. The constraints were; the bridge profile and horizontal alignment could not be altered because they must match the existing access locations for the impacted buildings and parking structures, the profile had to maintain minimum vertical clearance over the existing and proposed railroad tracks, and the access points for the building doors and parking ramps could not be changed.

Current project status: The Project Concept Report has been approved. Preparation of the Draft Environmental Assessment is underway. Right-of-way acquisition will be done by the City of Atlanta. Construction is scheduled for 2017.

Results Obtained

The VE team focused their efforts on the high cost items of the project. Through the use of functional analysis and "brain storming" techniques, the team generated 28 ideas with 17 being identified for additional evaluation as possible recommendations or design suggestions. The VE team developed six independent recommendations and three alternative recommendations. Implementation of the six independent recommendations has the potential to reduce the project cost by approximately $0.7 – 0.97 million. A detailed write-up of each recommendation is contained in the respective portion of this report. A summary of the recommendations follows.

Summary of Recommendations

Idea A-8: Construct a protected pedestrian walkway through the construction area between University Center and Library North.

The original design does not include any protected pedestrian access across the designated construction area on the Georgia State University campus.

This recommendation would construct a protected walkway diagonally across the Collins Street construction area near Station 24+20 for pedestrians crossing between the Library North / courtyard and the student center. The project area and work zone traverses a critical area of the Georgia State University campus, bisecting access for important areas of the campus including the student center, libraries, sports arena, Sparks Hall and classroom facilities.

The potential cost increase if accepted is $20,000.

Idea B-1: Use Class A Concrete for the Sidewalks on the Bridge.

The original concept proposes to construct sidewalks on the bridge with Class AA Superstructure Concrete.

This recommendation would construct the sidewalks on the new Courtland Street Bridge using Type A concrete in-lieu-of Type AA concrete. This project involves the construction of a long bridge with wide sidewalks on both sides of the structure. The sidewalk does not provide any additional structural support to the bridge.

The potential cost savings if accepted is $87,000.

Idea B-2: Eliminate the bridge parapet alongside the Library North Building.

The original concept proposes to construct a parapet wall alongside the Library North building.

This recommendation eliminates the parapet wall alongside the Library North building. The current design includes a wider sidewalk in this area and eliminates the gap between the bridge and the face of the building.

The potential cost savings if accepted is $32,000.

Idea D-1: Use Steel Beams in-lieu-of Bulb Tee Modified 65-inch Beams to span over both MARTA and the CSX Railroad tracks.

The original design proposes to install 125-foot Bulb Tee Modified 65-inch beams to cross over the MARTA and CSX Railroad tracks.

This recommendation would install 125-foot Structural Steel Beams in-lieu-of the Bulb Tee Modified 65-inch beams across the MARTA and CSX Railroad tracks. Installing lighter weight steel beams across the tracks minimizes risk, can be accomplished in less time thereby reducing track outages and the amount of railroad Force Account needed for this phase of construction.

The potential cost savings if accepted is $42,000.

Idea D-2: Construct the Courtland Street Bridge North of the CSX Railroad crossing (Pier 4) using only Type III Beams with eight, 81-foot spans and one, 85-foot span.

The original design for this section (Pier 4 to the north abutment) includes nine bridge spans. It includes two, 130-foot Bulb Tee 63-inch beam spans, one, 103-foot Bulb Tee 54-inch beam span, three, 80-foot Type III beam spans, and three, 50-foot Type I beam spans. This section passes through Georgia State University in a narrow 60-foot corridor where it abuts various university buildings.

This recommendation revises the bridge spans between Pier 4 and the north abutment to provide eight 81-foot spans and one, 85-foot span using smaller, lighter, and easier to handle Type III beams. Reducing the bridge span lengths and using smaller Type III beams will simplify, accelerate, and reduce the cost of construction. Providing a uniform beam size and type also simplifies the beam manufacturing, delivery, and storage process. Using smaller Type III beams also reduces the size of the caissons and piers needed for the substructure further simplifying / accelerating construction and reducing project cost.

The potential cost savings if accepted is $368,000.

Idea D-2.1: <u>Alternative to D-2</u> Construct the Courtland Street Bridge North of the CSX Railroad crossing (Pier 4) using piers set parallel to the roadway and Type II beams perpendicular to the roadway.

The original design for this section (Pier 4 to the north abutment) includes nine bridge spans. It includes two, 130-foot Bulb Tee 63-inch beam spans, one, 103-foot Bulb Tee 54-inch beam span, three, 80-foot Type III beam spans, and three, 50-foot Type I beam spans. This section passes through Georgia State University in a narrow 60-foot corridor where it abuts various university buildings.

This recommendation revises the bridge spans between Pier 4 and the north abutment to provide for a substructure parallel to the roadway with smaller Type II Beams perpendicular to roadway. This concept simplifies construction and allows all work to be accomplished within the narrow (60-foot) construction footprint. The small single beam type simplifies manufacturing, delivery, and storage. This concept sets the parallel caissons / piers at approximately 30-foot centers and incorporates the four newer piers from the existing span crossing Decatur Street into the parallel substructure. The shorter pier spacing also results in smaller size caissons and piers further simplifying construction and reducing project cost.

The potential cost savings if accepted is $591,000.

Idea D-2.2: Alternative to D-2 Salvage / strengthen (using micro piles and pier encasement) and reuse the existing columns and footings.

The original design demolishes and abandons the existing bridge footings and columns. It would construct nine new spans between Pier 4 and the north abutment. These spans includes two, 130-foot Bulb Tee 63-inch beam spans, one, 103-foot Bulb Tee 54-inch beam span, three, 80-foot Type III beam spans, and three, 50-foot Type I beam spans. This section passes through Georgia State University in a narrow 60-foot corridor where it abuts various university buildings.

This recommendation would salvage and strengthen the existing footings and columns using a micro-piling system, thereby allowing them to be reused as part of the new bridge's substructure. This concept keeps the footings in their existing locations reducing the risk of a conflict with an unknown subsurface feature / utility. Rehabilitation of the existing footings and columns allows most of the substructure work to be performed without the need to close Courtland Street, thereby reducing the road closure duration. This concept reduces construction time and project cost.

The potential cost savings if accepted is $192,000.

Idea D-3: Construct the Courtland Street Bridge South of the CSX Railroad crossing (Pier 3) using Type III beams with three, 85-foot spans.

The original design includes two long bridge spans between the south abutment and Pier 3 at the south side of the CSX Railroad crossing. The long spans (135 feet and 130 feet) require the use of large Bulb Tee 72-inch beams.

This recommendation revises the spans between the south abutment and the Pier 3 to provide three shorter (85-foot) spans with smaller Type III beams. This recommendation also relocates the south abutment from Station 13+25 to Station 13+35. The delivery, storage, and erection of the original design's large Bulb Tee 72-inch beams with 135 and 130-foot spans will likely require construction easements to store the beams and provide an area to setup the necessary construction equipment to erect them. The VE concept uses smaller, shorter length Type III beams that likely can be stored and erected on site simplifying construction and reducing cost. Smaller beams also result in reduced pier and caisson sizes.

The potential cost savings if accepted is $168,000.

Idea D-3.1: <u>Alternative to D-3</u> Construct the Courtland Street Bridge South of the CSX Railroad crossing (Pier 3) using Bulb Tee 54-inch beams with 88-foot spans.

The original design includes two long bridge spans between the south abutment and Pier 3 at the south side of the CSX Railroad crossing. The long spans (135 feet and 130 feet) require the use of large Bulb Tee 72-inch beams.

This recommendation revises the bridge spans between the south abutment and Pier 3 to provide three shorter 88-foot spans with smaller Bulb Tee 54-inch beams. This concept uses smaller

piers and allows the south abutment to remain in its proposed location. The smaller Bulb Tee 54-inch beams with 88-foot spans can likely be stored and erected on site simplifying construction and reducing cost.

The potential cost savings if accepted is $17,000.

Courtland Street Bridge Replacement

SUMMARY OF POTENTIAL COST SAVINGS

ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	SAVINGS POTENTIAL* (%)
	RECOMMENDATIONS						
A-8	Construct a protected pedestrian walkway through the construction area between University Center and Library North.	$0	($20,000)	($20,000)	N/A	($20,000)	100
B-1	Use Class A Concrete for the Sidewalks on the Bridge.	$393,000	$306,000	$87,000	N/A	$87,000	100
B-2	Eliminate the bridge parapet alongside the Library North Building.	$32,000	$0	$32,000	N/A	$32,000	100
D-1	Use Steel Beams in-lieu-of Bulb Tee Modified 65-inch beams to span over both MARTA and the CSX Railroad tracks.	$330,000	$288,000	$42,000	N/A	$42,000	100
D-2	Construct the Courtland Street Bridge North of the CSX Railroad crossing (Pier 4) using only Type III beams with eight, 81-foot spans and one, 85-foot span.	$2,241,000	$1,873,000	$368,000	N/A	$368,000	100
D-2.1	**Alternative to D-2** Construct the Courtland Street Bridge North of the CSX Railroad crossing (Pier 4) using piers set parallel to the roadway and Type II beams perpendicular to the roadway.	$3,106,000	$2,515,000	$591,000	N/A	$591,000	100

Courtland Street Bridge Replacement

SUMMARY OF POTENTIAL COST SAVINGS

ITEM No.	CREATIVE IDEA DESCRIPTION	ORIGINAL INITIAL COST	PROPOSED INITIAL COST	INITIAL COST SAVINGS	FUTURE SAVINGS	TOTAL LIFE CYCLE SAVINGS	SAVINGS POTENTIAL* (%)
D-2.2	**Alternative to D-2** Salvage / strengthen (using micro piles and pier encasement) and reuse the existing columns and footings.	$3,106,000	$2,914,000	$192,000	N/A	$192,000	100
D-3	Construct the Courtland Street Bridge South of the CSX Railroad crossing (Pier 3) using Type III beams with three, 85-foot spans.	$968,000	$800,000	$168,000	N/A	$168,000	100
D-3.1	**Alternative to D-3** Construct the Courtland Street Bridge South of the CSX Railroad crossing (Pier 3) using Bulb Tee 54-inch Beams with 88-foot spans.	$968,000	$951,000	$17,000	N/A	$17,000	100
	* Note: Savings Potential represents how much of an individual item, exclusive of any overlapping dependent items, can be implemented.						

STUDY IDENTIFICATION

Study Identification

Project: Courtland Street Bridge Replacement	**Date:** March 7-10, 2011
Location: Downtown Atlanta, Georgia	

VE Team Members

Name:	Title:	Organization:	Telephone:
George Obaranec, PE, AVS	Design	MACTEC	770-421-3346
Steven Gaines, PE	Construction	Wolverton & Associates	770-447-8999
Aruna Sastry, PE	Structures	Sastry & Associates	678-366-9375
Keith Borkenhagen, PE, CVS	VE Team Facilitator	MACTEC	623-556-1875

Project Description

This project will replace the Courtland Street Bridge in Atlanta, GA. The project was originally proposed to replace only the two spans over the CSX Railroad to provide horizontal and vertical clearances for a third set of tracks. However, due to continued deterioration of the remaining portions of the existing Courtland Street Bridge and the low sufficiency rating, this project has been expanded to replace the entire 28 span structure. This existing bridge abuts several Georgia State University buildings and parking structures so the new bridge will have to maintain the same vertical and horizontal alignment to accommodate the many building and parking structure entrance / exit ramps. The buildings are 60 feet apart and the new structure will be constructed immediately adjacent to and abutting these buildings. Major contract work items include removal of the existing structure, bridge substructure, bridge superstructure, MSE wall construction / repair, bridge approach slabs, and resurfacing the approach roadway. The total estimated project construction cost is $14.98 million.

Conditions / Constraints

The VE team was presented with several constraints to consider when developing their recommendations. They were;

- The bridge profile could not be altered because it must match the existing entrance and exit locations for the impacted buildings and parking structures.
- The profile had to maintain minimum vertical clearance over the existing and proposed railroad tracks.

- The bridge horizontal alignment could not be altered because of the close proximity of the impacted buildings and parking structures.
- The access points for the building doors and parking ramps could not be changed.

Project Briefing

An overview of the current project status was presented by Albert Shelby from Roadway Design and Sean Garland from Hatch Mott MacDonald. The following items were discussed:

- This project has gone through several concept changes prior to developing the current design to replace all of the spans of the existing Courtland Street Bridge. The first concept only proposed to replace the two spans crossing the MARTA and CSX Railroad. Due to the deteriorating structural condition of the bridge, it has been decided to replace the entire structure.
- According to the latest Bridge Inspection Report, the entire substructure needs to be replaced.
- The existing structure is extremely close to adjacent university buildings and the new structure will be immediately adjacent to the same buildings. The entire project (bridge removal and bridge construction) will be constructed within a 60-foot footprint. Few open adjacent areas exist north of the railroad to set large construction equipment to demolish the existing structure and construct the new structure.
- The City of Atlanta will buy the required R/W to reconstruct the entire bridge. The City will also handle detouring traffic while the road / bridge is closed to traffic.
- The vertical controls for the new structure are; the clearance required over the CSX Railroad, the clearance required over Decatur Street, the existing access points from the building doors and parking ramps.
- Continued access for the freight depot on the south side of the railroad is desirable.
- This project is in the middle of the Georgia State University campus and some type of pedestrian access will have to be maintained.
- Project construction is expected to take about 1 ½ years and the staging needs to be coordinated with Georgia State University to minimize adverse impact to pedestrian traffic crossing the work area.

The following individuals attended the project design briefing.

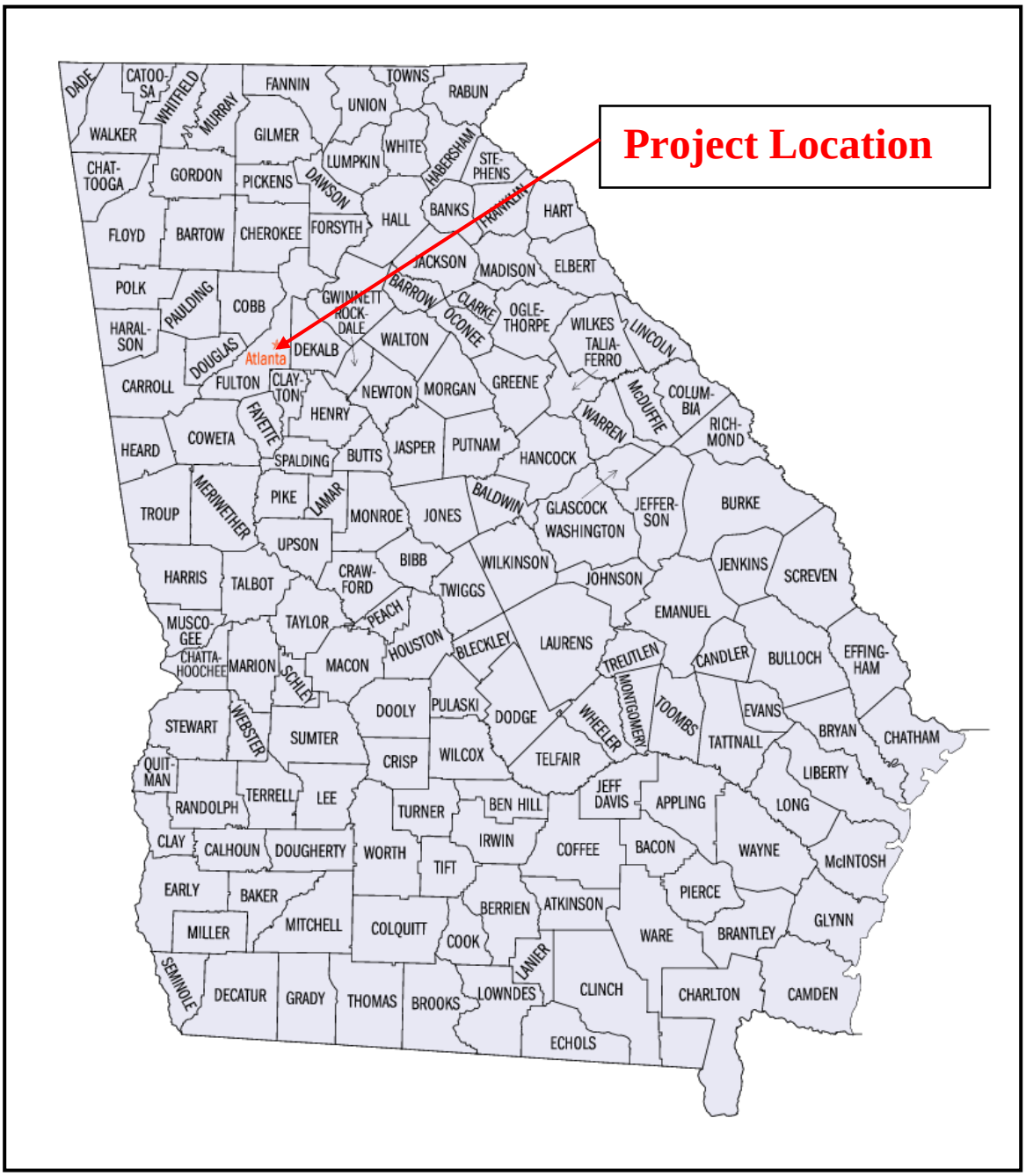
Lisa Myers	GDOT	Matt Sanders	GDOT
Ron Wishon	GDOT	Dona Lee Welch	GDOT – District
Bill DuVall	GDOT	Sean Garland	Hatch Mott MacDonald
Albert Shelby	GDOT	Mindy Sanders	Hatch Mott MacDonald
Stanley Hill	GDOT	Samuel Williams	GDOT
Emory Harris	GDOT	Laura Rish	GDOT
Sam Pugh	GDOT	Aruna Sastry	Sastry and Associates
George Obaranec	MACTEC	Steven Gaines	Wolverton & Associates
Keith Borkenhagen	MACTEC		

Project Site Visit

As part of the information phase of the study, the VE team visited the project site. The following items were observed:

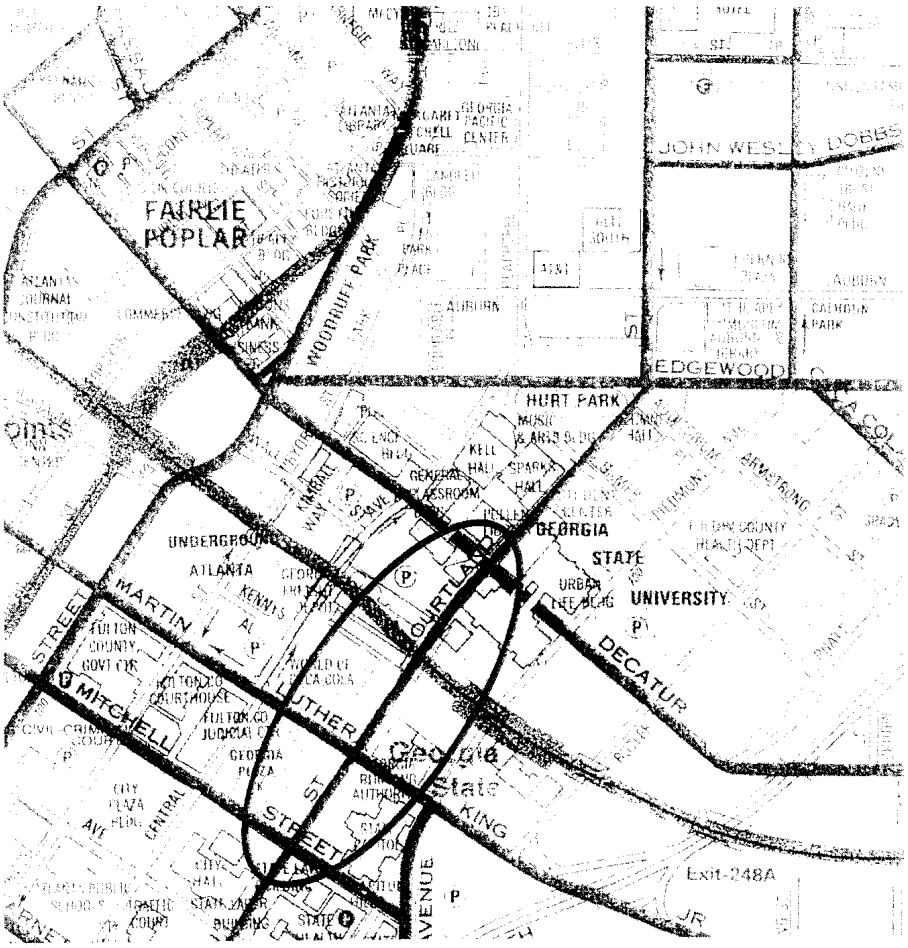
- The existing bridge deck abuts the adjacent buildings.
- The existing bridge has a vertical wall/parapet alongside the Library North building. This is most likely because it is the only location on the bridge where the bridge deck is about 1-foot or more away from the building face.
- There is protective netting installed under the bridge deck from north of the RR tracks to the northern abutment to protect the pedestrian area below from falling concrete and other bridge pieces.
- The proposed construction area, especially north of the CSX tracks, has very heavy pedestrian traffic that passes under the existing structure. There is heavy pedestrian traffic crossing at Decatur Street also.
- The existing bridge pier in the center of the MARTA and CSX Railroad is in line with one line of building columns for the large parking structure on the west side of the project.
- The CSX Railroad has only one active track under the existing structure. The CSX Railroad has two active tracks east of the bridge. The CSX Railroad has an old inactive spur track that goes under the existing bridge.

Figure 1
Project Vicinity Map



County Map of Georgia

Figure 2
Project Sketch Map



VE RECOMMENDATIONS

DEVELOPMENT AND RECOMMENDATION PHASE

Project: Courtland Street Bridge Replacement

IDEA No.: A-8	**Sheet No.:** 1 of 4	**CREATIVE IDEA:** Provide pedestrian access throughout construction

Comp By: GAO Date: 03/08/2011 Checked By: KB Date: 03/10/2011

Original Concept: Detailed pedestrian access plans have not been developed. The current proposal is to simply close the building access abutting Courtland Street and Collins Street and reroute pedestrian traffic via Gilmore Street around the north end of the construction zone.

Proposed Change: This recommendation would construct a protected walkway diagonally across the Collins Street construction area near Station 24+20 for pedestrians crossing between the Library North / courtyard and the student center.

Justification: The project area and work zone traverses a critical area of the Georgia State University campus, bisecting access for important areas of the campus including the student center, libraries, sports arena, Sparks Hall and classroom facilities. As such, it receives extremely heavy pedestrian traffic.

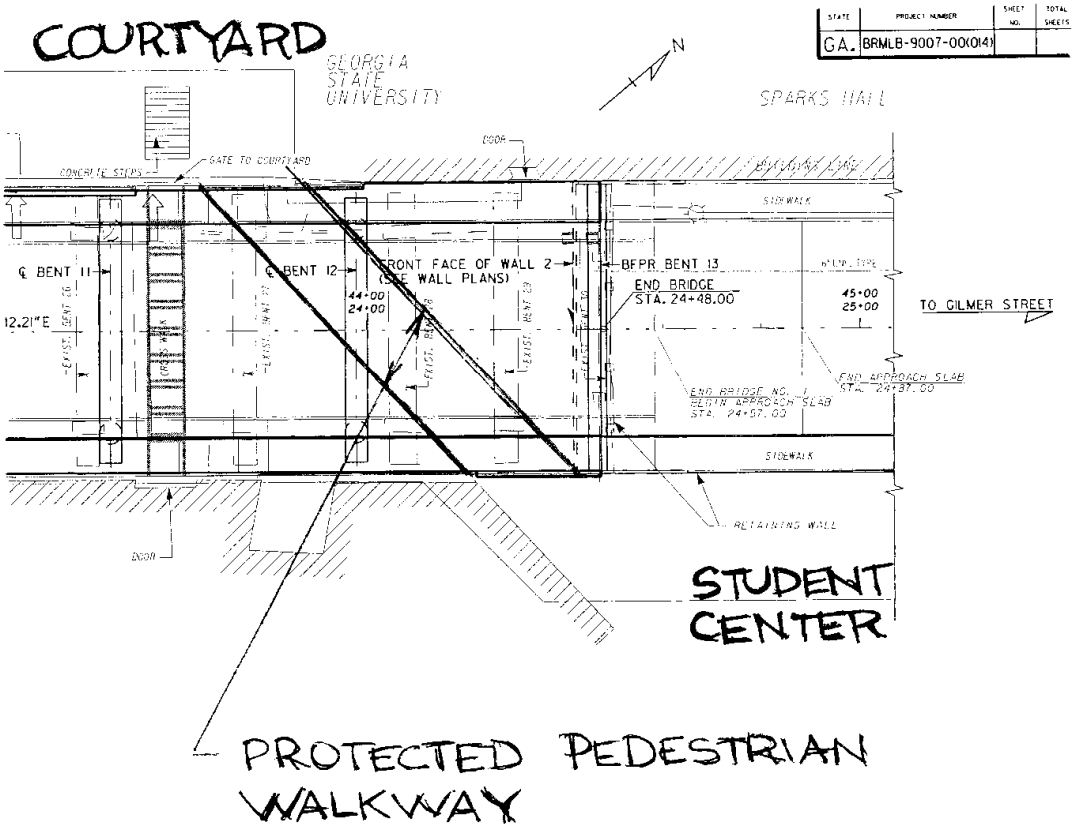
Realistically, pedestrians will attempt to use the shortest distance between two points. They will try to walk through the work zone areas even if barricaded and fenced. This concept would construct a protected pedestrian walkway / zone through the construction area rather than rerouting pedestrians around the north end of the bridge to Gilmer Street. The protected walkway would provide a controlled and direct access route. Currently, Collins Street serves essentially as a pedestrian only zone with vehicular access limited to campus parking and delivery / maintenance vehicles. Conversely, Gilmer Street is an active roadway, with limited sidewalk space and two-way vehicular traffic increasing the potential for a pedestrian incident.

Construction around the proposed walkway should be monitored to determine whether the walkway may need to be closed for short durations to complete a specific phase of work impacting the area.

COST SUMMARY	**INITIAL COST**	**FUTURE COST**	**TOTAL L. C. COST SAVINGS**
Original	$0		
Proposed	($20,000)		
Savings	($20,000)		($20,000)
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**($20,000)**

SKETCH

Project: Courtland Street Bridge Replacement	Idea No.: A-8 Client: GDOT Sheet 2 of 4



COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: A-8 Client: GDOT Sheet 3 of 4		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:		0	$0	$0			
VE Design:							
Pedestrian walkway	LF				80	$250	$20,000
SUBTOTAL				$0			$20,000
TOTAL ROUNDED				**$0**			**$20,000**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: A-8 Client: GDOT Sheet 4 of 4

VE Design:

Construct a covered pedestrian walkway through the construction area near Station 24+20

Assume a cost for the pedestrian walkway at $250 per lineal foot.

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: B-1	**Sheet No.:** 1 of 3	**CREATIVE IDEA:** Use Class A Concrete for the Sidewalk on the Bridge
Comp By: SG Date: 03/09/2011 Checked By: KB Date: 03/10/2011		

Original Concept:

The original concept proposes to construct sidewalks on the bridge with Class AA Superstructure Concrete.

Proposed Change:

This recommendation would construct the sidewalks on the new Courtland Street Bridge using Type A concrete in-lieu-of Type AA concrete.

Justification:

This project involves the construction of a long bridge with wide sidewalks on both sides of the structure. The purpose of the sidewalk on the bridge is to allow for pedestrian access along the bridge. The sidewalk does not provide any additional structural support to the bridge. During construction of the bridge, the sidewalk will be constructed in a separate pour from the bridge deck. Type A concrete will provide sufficient strength for the pedestrian traffic.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$393,000		
- Proposed	$306,000		
- Savings	$87,000		$87,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$87,000**

COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: B-1 Client: GDOT Sheet 2 of 3		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Bridge Sidewalk (Type AA)	CY	291	$1,350.04	$392,862			
VE Design:							
Bridge Sidewalk (Type A)	CY				291	$1,058.67	$306,073
SUBTOTAL				$392,862			$306,073
TOTAL ROUNDED				**$393,000**			**$306,000**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: B-1 Client: GDOT Sheet 3 of 3

Bridge Length = 1,123 feet
Sidewalk Depth = 0.5-foot
Sidewalk Width = 7 feet

Sidewalk Volume = 2 x (7 ft x 0.5 ft x 1,123 ft) = 7,861 CF / 9 = 291 CY

Unit Cost (Concrete Sidewalk, 6 in) = $23.06 / SY => $138.36 / CY

<u>Original Concept</u>

Volume (Class AA Concrete) = 291 CY

<u>Revised Concept</u>

Volume (Class A Sidewalk, 6 in) = 291 CY

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: B-2	**Sheet No.:** 1 of 3	**CREATIVE IDEA:** Eliminate Parapet Alongside Library North Building
Comp By: SG Date: 3-10-11 Checked By: KB Date: 3-10-11		

Original Concept:

The original concept proposes to construct a parapet wall alongside the Library North building.

Proposed Change:

This recommendation eliminates the parapet wall alongside the Library North building.

Justification:

The existing bridge has a narrow (4+ inches) parapet alongside the Library North building with a gap of approximately 1.5 feet between the outside of the parapet and the building face. The current design includes a wider sidewalk in this area by eliminating the gap between the bridge and the face of the building. The parapet can be eliminated since the proposed sidewalk will extend to the face of the building.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	$32,000		
Proposed	$0		
Savings	$32,000		$32,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$32,000**

COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: B-2 Client: GDOT Sheet 2 of 3		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Class AA Concrete	CY	24	$1,350.04	$32,400.96			
VE Concept:							
Class AA Concrete	CY				0	$0	$0
SUBTOTAL				$32,400.96			$0
TOTAL ROUNDED				**$32,000.00**			**$0**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: B-2 Client: GDOT Sheet 3 of 3

Parapet Length Alongside Library North = 170 feet
Assumed Parapet Width = 1’ 1” = > 1.08 feet
Assumed Parapet Height = 3’ 6” = > 3.5 feet

Volume = 170 ft x 1.08 ft x 3.5ft = 642.6 CF => 23.8 CY

<u>Original Concept</u>

Volume (Class AA Concrete) = 23.8 CY => 24 CY

<u>Revised Concept</u>

Volume (Class AA Concrete) = 0 CY

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: D-1	**Sheet No.:** 1 of 3	**CREATIVE IDEA:** Use Steel Beams in-lieu-of Bulb Tee Modified 65-inch beams to span over both MARTA and the CSX Railroad tracks.
Comp By: SG Date: 3-10-11 Checked By: KB Date: 03/10/2011		

Original Concept:

The original design proposes to install 125-foot Bulb Tee Modified 65-inch beams to cross over the MARTA and CSX Railroad tracks.

Proposed Change:

This recommendation would install 125-foot Structural Steel beams in-lieu-of the Bulb Tee Modified 65-inch beams across the MARTA and CSX Railroad tracks.

Justification:

The proposed bridge replacement requires spanning railroad tracks owned by both MARTA and the CSX Railroad. Rail traffic on these tracks is very heavy and providing adequate track outages to install the large, heavy Bulb Tee Modified 54-inch beams could severely impact rail service. Installing lighter weight steel beams across the tracks could be accomplished in less time and reduce the amount of track outages required for construction over the railroads. Reducing the construction time over the railroads would also reduce the amount of railroad Force Account needed for this phase of construction thereby reducing project costs. The use of steel beams would also reduce the construction risk for this work.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$330,000		
- Proposed	$288,000		
- Savings	$42,000		$42,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$42,000**

COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: D-1 Client: GDOT Sheet 2 of 3		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Bulb Tee Modified 65" Beams	LF	875	$377.36	$330,190.00			
VE Design:							
Structural Steel Beams	EA				6	$48,005	$288,030.00
SUBTOTAL				$330,190.00			$288,030.00
TOTAL ROUNDED				**$330,000.00**			**$288,000.00**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-1 Client: GDOT Sheet 3 of 3

Original Design: Bulb Tee Modified 65-inch Beams

Span Length = 125 feet
Assume Seven Bulb Tee-65inch Beams are required.

Beam Length = 125 ft x 7 beams = 875 feet

VE Design: Use Structural Steel Beams

Beam Required: Steel Section of 18” x 2” Flanges with 5’ x 1/2” Web
Beam Length: 125 feet
Beam Weight: 28,073 lbs
Beam Cost: 28,073 lbs @ $1.71 / lb = $48,005
Number of beams: Use 6 Beams

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: D-2	**Sheet No.:** 1 of 6	**CREATIVE IDEA:** Construct the Courtland Bridge north of the CSX Railroad using Type III beams with eight, 81-footspans and one, 85-foot span.
Comp By: AS Date: 03/08/2011 Checked By: KB Date: 03/11/2011		

Original Concept:

The original design for the bridge section between Pier 4 on the north side of the CSX Railroad crossing and the north abutment includes nine bridge spans. This portion of the bridge passes through Georgia State University where it abuts various buildings (Sparks Hall, University Center, Library North, Library South, Courtland Building, and a Parking Structure). The bridge deck (old and new) through this area is only 58 feet wide. The proposed design for this section includes two, 130-foot spans, one, 103-foot span, three, 80-foot spans, and three, 50-foot spans. These span lengths use Bulb Tee 63-inch beams, Bulb Tee 54-inch beams, Type III beams, and Type I beams.

Proposed Change:

This recommendation revises the bridge spans between Pier 4 and the north abutment to provide one, 85-foot span and eight 81-foot spans thereby using only smaller Type III beams.

Justification:

Constructing the bridge section north of the CSX Railroad crossing will be done within a very confined area between several Georgia State University buildings. These building are only about 60 feet apart and the new bridge deck will be only inches away from these buildings. The VE concept uses smaller spans and lighter, easier to handle Type III beams. The original design includes two 120-foot spans requiring Bulb Tee 63-inch beams, one 103-foot span requiring Bulb Tee 54-inch beams, three 80-foot spans using Type III beams, and three 150 spans using Type I beams.

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	$2,241,000		
Proposed	$1,873,000		
Savings	$368,000		$368,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$368,000**

CONTINUATION

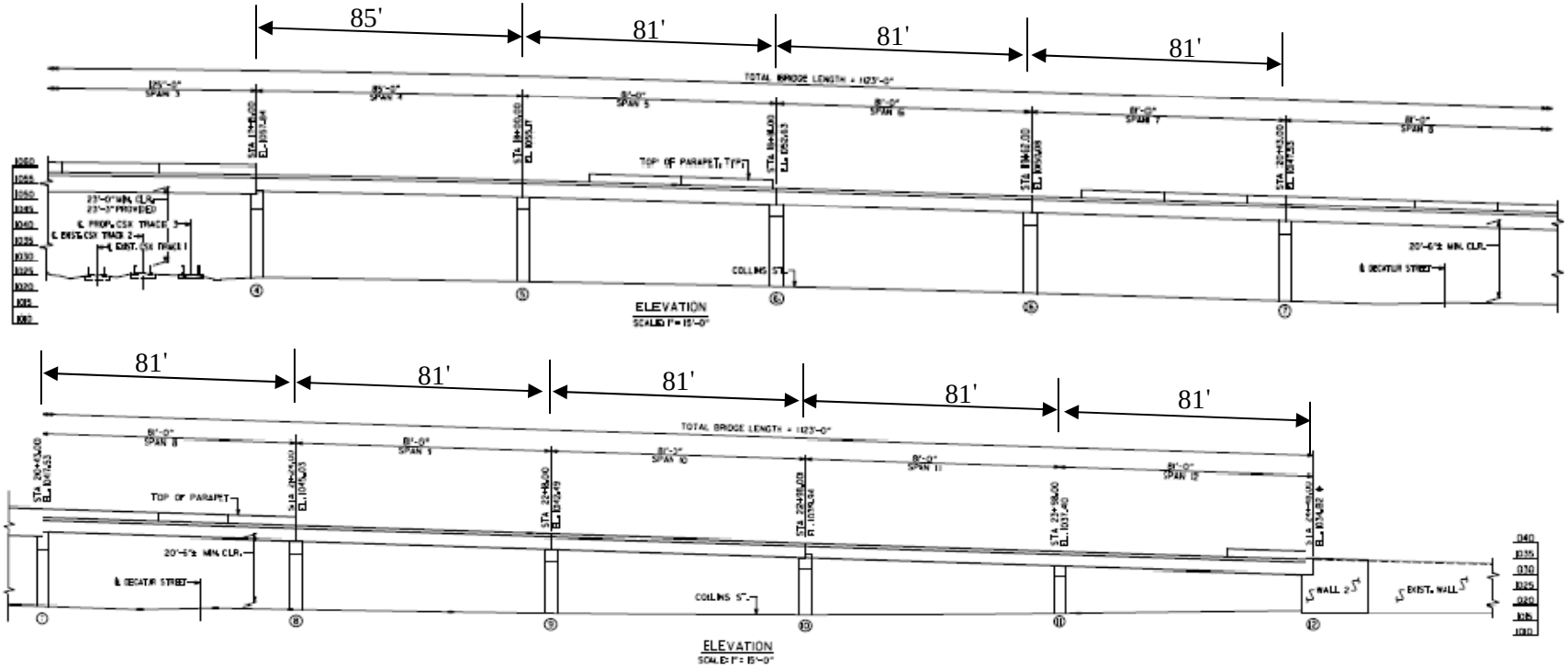
Project: Courtland Street Bridge Replacement	Idea No.: D-2 Client: GDOT Sheet 2 of 6

Installing the original design's large Bulb Tee beams in the very narrow (60 feet) work area between the tall university buildings and with very limited open areas to set-up the required construction equipment need to maneuver these large beams will likely result in higher than normal construction costs for this type of project. Reducing the bridge span lengths and using smaller Type III beams for this section of the project will simplify, accelerate, and reduce the cost of construction.

The VE concept provides for uniformity of beam size and type thereby simplifying the beam manufacturing, delivery, and storage process. The VE concept uses 56 Type III beams with 81-foot spans and 7 Type III beams with 85-foot spans. The original concept uses 14 Bulb Tee 63-inch beams with 120-foot spans, 7 Bulb Tee 54-inch beams with 103-foot spans, 21 Type III beams with 80-foot spans and 21 Type I beams with 50-foot spans. Using the smaller uniform Type III beam size will also reduce the size of the caissons and piers needed for the substructure further simplifying / accelerating construction and reducing project cost.

SKETCH	
Project: Courtland Street Bridge Replacement	Idea No.: D-2 Client: GDOT Sheet 3 of 6

Idea D-2 Station 17+15 to North Abutment
Reduce Span Lengths and Construct Using all Type III Beams
Eight Beam Spacing at 81 feet & One Beam Spacing at 85 feet



COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: D-2 Client: GDOT Sheet 4 of 6		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Bulb Tee 63-inch Beams	LF	1,747	$377.36	$659,248			
Bulb Tee 54-inch Beams	LF	808	$360.44	$291,236			
Type III Beams	LF	1,872	$283.78	$531,236			
Type I Beams	LF	1,152	$208.28	$239,939			
Large Piers for BT 63” Beams	LS	3	$173,000	$519,000			
VE Design:							
Type III Beams	LF				5,131	$283.78	$1,456,075
Small Piers for Type III Beams	LS				3	$139,000	$417,000
SUBTOTAL				$2,240,659			$1,873,075
TOTAL ROUNDED				**$2,241,000**			**$1,873,000**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-2 Client: GDOT Sheet 5 of 6

Bridge Pier Stationing Between CSX Railroad North Pier and North Abutment

Original Design	Station	Beam / Length	VE Design	Station	Beam / Length
Pier 4	17+15		Pier 4	17+15	
		BT 54 103 ft			Type III 85 ft
Pier 5	18+18		Pier 5	18+00	
		BT 63 120 ft			Type III 81 ft
Pier 6	19+38		Pier 6	18+81	
		BT 63 120 ft			Type III 81 ft
Pier 7	20 +58		Pier 7	19+62	
		Type III 80 ft			Type III 81 ft
Pier 8	21+38		Pier 8	20+43	
		Type III 80 ft			Type III 81 ft
Pier 9	22+18		Pier 9	21+24	
		Type III 80 ft			Type III 81 ft
Pier 10	22+98		Pier 10	22+05	
		Type I 50 ft			Type III 81 ft
Pier 11	23+48		Pier 11	22+86	
		Type I 50 ft			Type III 81 ft
Pier 12	23+98		Pier 12	23+67	
		Type I 50 ft			Type III 81 ft
North Abutment	24+48		North Abutment	24+48	

Revised Pier Spacing North of CSX North Railroad Pier

# Spans	Beam	Span	# Beams	Total Length	Cost / Foot	Total Cost
Original						
2	BT 63	120 ft	Plan Est.	1,747 ft	$377.36	$659,247.92
1	BT 54	103 ft	Plan Est.	808 ft	$360.44	$291,235.52
3	Type I	50 ft	Plan Est.	1,152 ft	$208.28	$239,938.56
3	Type III	80 ft	Plan Est.	1,872 ft	$283.78	$531,236.16
						$1,721,661.16
VE						
8	Type III	81 ft	7	4,536 ft	$283.78	$1,287,226.08
1	Type III	85 ft	7	595 ft	$283.78	$168,849.10
						$1,456,075.18

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-2 Client: GDOT Sheet 6 of 6

Pier Adjustments

Original Design: 3 Large Piers for BT 63" Beams Spanning 120 feet

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 4 ft diameter x 17.5 ft **average height** x 2 column x 1 / 27 = 16.29 CY @ $1,058 = $17,234,54
Rebar: 47.7 CY x 150 lb / CY = 7,155 lb @ $1.00 = $7,155
Drilled 54" Caisson: 2 @ 30 ft @ $1,924 / ft = $115,440
Total Cost: $173,061 **USE** **$173,000**

VE Design: 3 Smaller Piers for Type III Beams

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 3 ft diameter x 17.5 ft **average height** x 2 column x 1 / 27 = 9.16 CY @ $1,058 = $9,691.28
Rebar: 40.57 CY x 150 lb / CY = 6,085.5 lb @ $1.00 = $6,085.50
Drilled 42" Caisson: 2 @ 30 ft **Assume a $1,500 / ft cost for 42" caisson** = $90,000
Total Cost: $139,008.56 **USE** **$139,000**

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: D-2.1	**Sheet No.:** 1 of 6	**CREATIVE IDEA: Alternative to D-2** Construct Courtland Bridge north of the CSX Railroad using Type II beams perpendicular to roadway and the cap parallel to the roadway (trellis bridge).
Comp By: AS Date: 03/08/2011 Checked By: KB Date: 03/10/2011		

Original Concept:

The original design for the bridge section between Pier 4 on the north side of the CSX Railroad crossing and the north abutment includes nine bridge spans. This portion of the bridge passes through Georgia State University where it abuts various buildings (Sparks Hall, University Center, Library North, Library South, Courtland Building, and a Parking Structure). The bridge deck (old and new) through this area is only 58 feet wide. The proposed design for this section includes two, 130-foot spans, one, 103-foot span, three, 80-foot spans, and three, 50-foot spans. These span lengths use Bulb Tee 63-inch beams, Bulb Tee 54-inch beams, Type III beams, and Type I beams.

Proposed Change:

This recommendation revises the bridge spans between Pier 4 and the north abutment to provide Type II PSC beams perpendicular to roadway with columns / caps parallel to the roadway.

Justification:

Constructing the bridge section north of the CSX Railroad crossing will be done within a very confined area between several Georgia State University buildings. These building are only about 60 feet apart and the new bridge deck will be only inches away from these buildings. The VE concept uses smaller caissons / piers placed parallel to the roadway and smaller Type II beams placed perpendicular to the roadway. The original design includes two 120-foot

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$3,106,000		
- Proposed	$2,515,000		
- Savings	$591,000		$591,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$591,000**

CONTINUATION

Project: Courtland Street Bridge Replacement	Idea No.: D-2.1 Client: GDOT Sheet 2 of 6

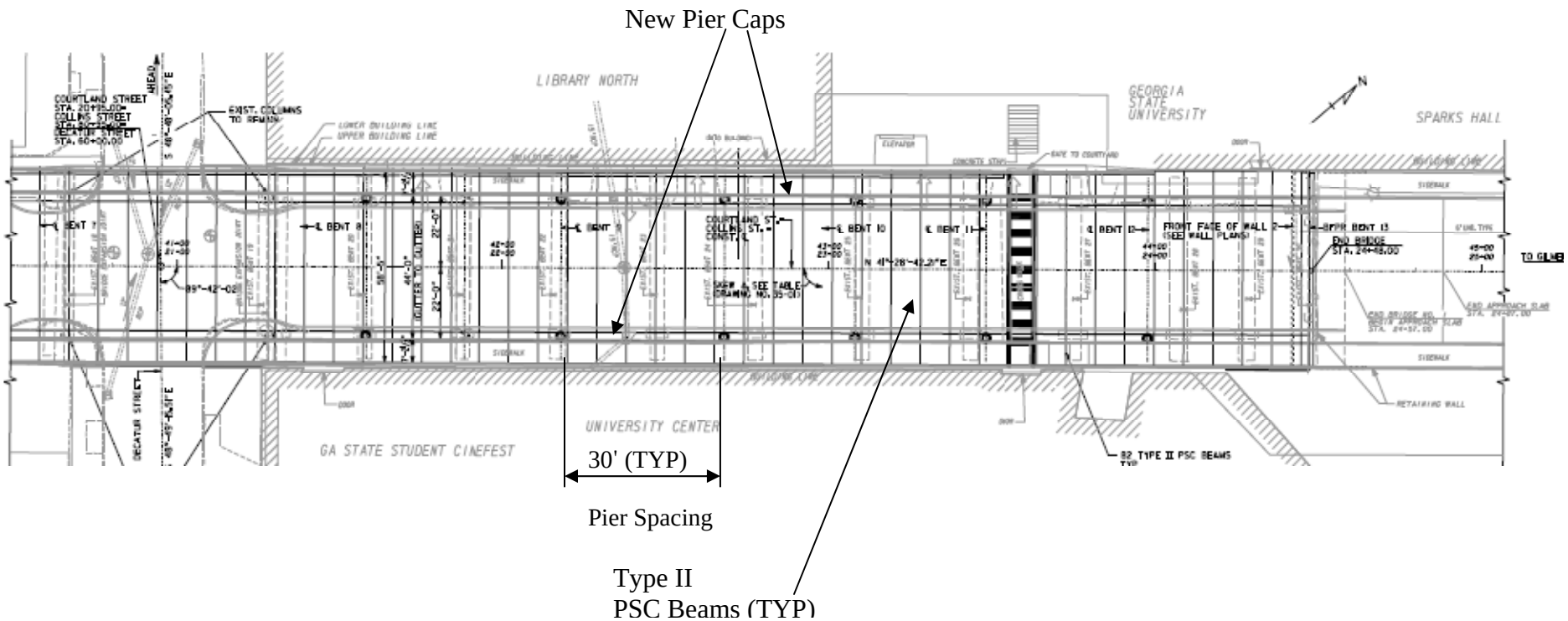
spans requiring Bulb Tee 63-inch beams, one 103-foot span requiring Bulb Tee 54-inch beams, three 80-foot spans using Type III beams, and three 150 spans using Type I beams.

Constructing the substructure parallel to the roadway with smaller Type II beams placed perpendicular to the roadway will simplify construction of the bridge's substructure. This concept allows all of the construction to be accomplished within the narrow (60-foot) construction footprint and likely eliminate the need for outside areas to set-up construction equipment to erect the original design. It also simplifies beam manufacturing, delivery, and storage since all 82 Type II beams are the same size.

This concept sets the parallel caissons / piers at approximately 30-foot centers and incorporates the four newer piers from the existing span crossing Decatur Street into the parallel substructure. The shorter pier spacing also results in smaller size caissons and piers further simplifying construction and reducing project cost. This option would enhance the opportunity to accommodate additional context sensitive design modifications for this portion of the bridge.

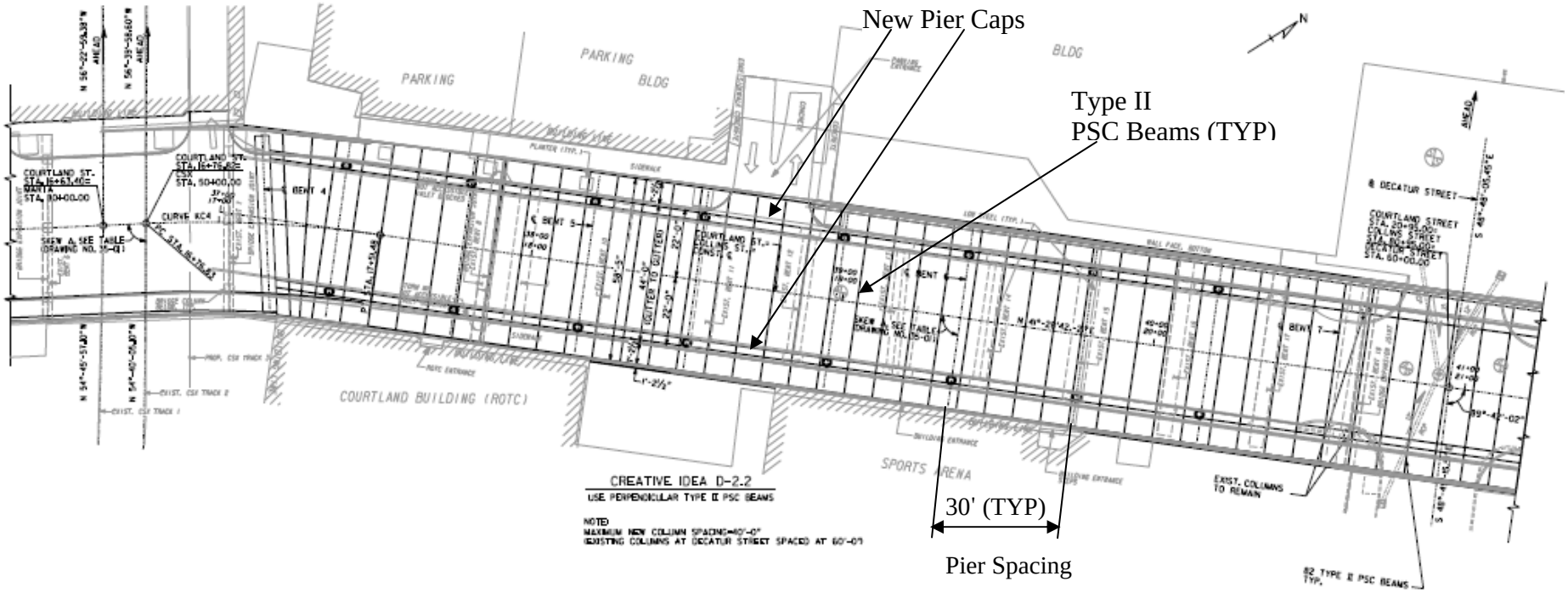
SKETCH	
Project: Courtland Street Bridge Replacement	Idea No.: D-2.1 Client: GDOT Sheet 3 of 6

Idea D-2.1 Station 17+15 to North Abutment
Set Pier Cap Parallel to Roadway
Piers Spaced about 30 feet Apart
Use Type II Beams Perpendicular to Roadway



SKETCH	
Project: Courtland Street Bridge Replacement	Idea No.: D-2.1 Client: GDOT Sheet 4 of 6

Idea D-2.1 Station 17+15 to North Abutment
Set Pier Cap Parallel to Roadway
Piers Spaced about 30 feet Apart
Use Type II Beams Perpendicular to Roadway



COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: D-2.1 Client: GDOT Sheet 5 of 6		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Bulb Tee 63-inch Beams	LF	1,747	$377.36	$659,248			
Bulb Tee 54-inch Beams	LF	808	$360.44	$291,236			
Type III Beams	LF	1,872	$283.78	$531,236			
Type I Beams	LF	1,152	$208.28	$239,939			
Large Piers	LS	8	$173,000	$1,384,000			
VE Design:							
Type II PSC Beams	LF				4,428	$246.03	$1,089,420
Small Piers for Type II Beams	LS				1	LS	$1,425,565
SUBTOTAL				$3,105,659			$2,514,985
TOTAL ROUNDED				**$3,106,000**			**$2,515,000**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-2.1 Client: GDOT Sheet 6 of 6

Pier Adjustments

Original Design: Large Piers for various Spans (50 - 120 feet)

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 4 ft diameter x 17.5 ft **average height** x 2 column x 1 / 27 = 16.29 CY @ $1,058 = $17,234,54
Rebar: 47.7 CY x 150 lb / CY = 7,155 lb @ $1.00 = $7,155
Drilled 54" Caisson: 2 @ 30 ft @ $1,924 / ft = $115,440
Total Cost: $173,061 **USE** **$173,000**

VE Design: Use Smaller Piers for Type II Beams perpendicular to roadway

Pier Cap: 2.5 ft x 2.5 ft x 733 ft long x 2 sides / 27 = 339.59 CY @ $1,058 = $359,261.62
Columns: 2.5 ft diameter x 17.5 ft average height / 27 x 30 piers = 95.45 CY @ $1,058 = $101,047.60
Rebar: 435.04 CY x 150 lb / CY = 65,256 lb @ $1.00 = $65,256.00
Drilled 36" Caisson: 30 @ 25 ft **Assume a $1,200 / ft cost for 36" caisson** = $900,000
Total Cost: $1,425,565.22 **USE** **$1,425,565**

NOTE: Piers have been placed to avoid driveways and building entrances.

Type II Beam Configuration:

Beams to be 54 feet long
Beams spaced at 9-foot centers
Number of Beams = 733 ft / 9 ft = 81.4 Use 82 Beams
82 Beams @ 54 ft = 4,428 ft

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: D-2.2	**Sheet No.:** 1 of 6	**CREATIVE IDEA: Alternative to D-2** Salvage / strengthen (using micro piles and pier encasement) and reuse the existing columns and footings.
Comp By: GAO Date: 3-9-11 Checked By: KB Date: 03/10/2011		

Original Concept: The current design would demolish and abandon the existing bridge footings and columns on the northern section of the bridge (Station 37+00 to 44+30).

Proposed Change: This recommendation would salvage and strengthen the existing footings and columns using a micro-piling system, thereby allowing them to be reused as part of the new bridge's substructure.

Justification: The existing substructure system between station 37+00 and 44+30 consists of piers spaced at about 30 feet. These piers consist of a deteriorated center concrete column, about 1 ½ foot square, abutted by two steel H piles that appear in relatively good condition. The makeup of the existing footings is not known but suspected / assumed to be spread footings. While the existing substructure cannot be guaranteed to be structurally sufficient, if the footings are reinforced with micro-piles and additional reinforced concrete, and the piers have the existing concrete center column removed and replaced with a reinforced concrete column constructed around the existing steel H piles, a potentially acceptable design could be developed.

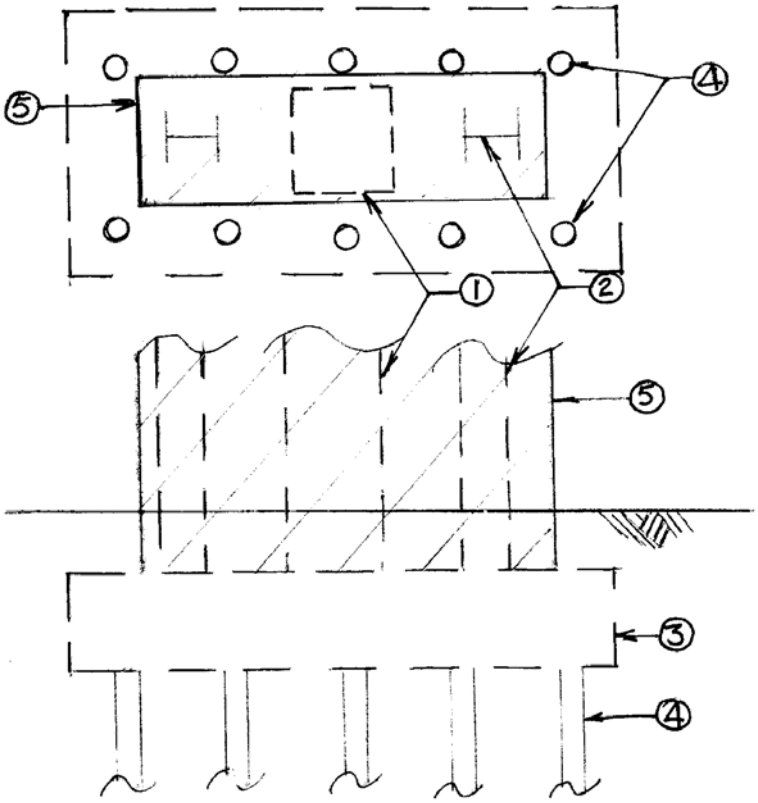
This concept results in several important, time-saving benefits. First, with the footings remaining in their existing locations, it significantly reduces the risk of a conflict with an unknown or unidentified subsurface feature / utility / underground storage tank. The original design shifts the pier footings to new locations increasing the likelihood of subsurface conflicts resulting in potential construction delays, increased cost, and service disruptions to the adjacent university buildings. Even with a pre-construction SUE investigation, drilling sixteen 4.5-foot diameter caissons in new areas introduces a significant potential underground conflict risk. Second, the rehab concept would allow most of the substructure work to be performed without the need to close Courtland Street, thereby reducing the duration of the road closure. The micro-piling

COST SUMMARY	INITIAL COST	FUTURE COST	TOTAL L. C. COST SAVINGS
Original	$3,106,000		
Proposed	$2,914,000		
Savings	$192,000		$192,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$192,000**

system and the additional reinforced concrete needed around the footings could be constructed while maintaining traffic on Courtland Street. It is unlikely the new larger 54-inch pier caissons can be constructed without removing the existing structure and closing the road. And third, using the same pier / footing locations, eliminates any conflicts with doorways, driveways or other access points. This recommendation was developed under the assumption that there is some reuse capabilities of the existing substructure since the existing steel columns appeared to be in good condition and can be easily tested for structural integrity.

The VE team did not attempt to calculate the cost for a utility conflict or unintended break or disruption in service. However, any such conflict would have a negative impact the project's construction schedule. This concept reduces the potential for an unforeseen utility / underground conflict; increases driver / pedestrian / customer satisfaction; and reduces the road closure duration for Courtland Street. The VE team did not assign any cost to reducing the time Courtland Street is closed.

SKETCH	
Project: Courtland Street Bridge Replacement	Idea No.: D-2.2 Client: GDOT Sheet 3 of 6



1. Existing concrete columns – to be demolished and removed
2. Existing steel H piles, 2 per column, to be retained and reused
3. Existing (assumed) spread footing, dimensions unknown
4. Proposed micro-pile foundation system, with new reinforced concrete cap
5. Proposed reinforced concrete support/column

Project: Courtland Street Bridge Replacement	Idea No.: D-2.2 Client: GDOT Sheet 4 of 6

S&A Atlanta

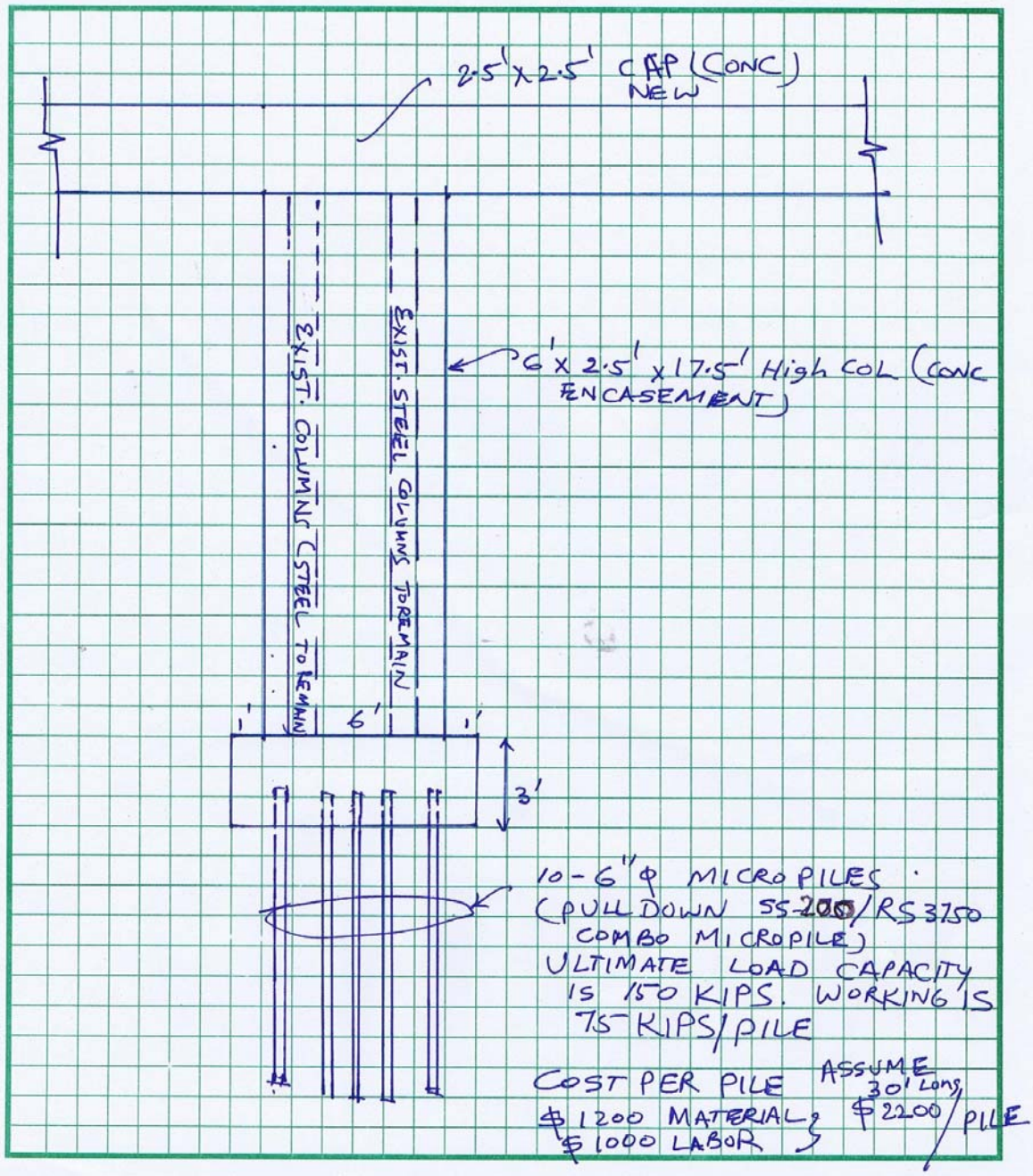
SASTRY AND ASSOCIATES, INC. PAGE ____ OF ____

PROJECT COURTLAND STREET SHEET NO. ____ OF ____

SUBJECT BRIDGE REHAB/REP. JOB NO. ____

VE STUDY MADE BY: AS DATE 3/16/2011

CHKD. BY: ____ DATE ____



COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: D-2.2 Client: GDOT Sheet 5 of 6		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
Large Piers	LS	8	$173,000	$1,384,000			
Bulb Tee 63-inch Beams	LF	1,747	$377.36	$659,248			
Bulb Tee 54-inch Beams	LF	808	$360.44	$291,236			
Type III Beams	LF	1,872	$283.78	$531,236			
Type I Beams	LF	1,152	$208.28	$239,939			
VE Design:							
Strengthen Pier / Footing	LS				1	$1,466,000	$1,466,000
Longitudinal Pier Cap	LS				1	$359,000	$359,000
Type II PSC Beams	LF				4,428	$246.03	$1,089,420
SUBTOTAL				$3,105,659			$2,914,420
TOTAL ROUNDED				**$3,106,000**			**$2,914,000**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-2.2 Client: GDOT Sheet 6 of 6

Pier Computations

VE Design: Use of existing Piers by retrofitting the foundation and columns utilizing Micro piles to add additional support.

Pier Cap: 2.5 ft x 2.5 ft x 733 ft long x 2 sides / 27 = 339.59 CY @ $1,058 = $359,261.62

Columns: 2.5 ft wide x 6 ft. along x17.5 ft high(avg) x 38 columns / 27 = 369.44 CY @ $1,058 = $390,872.22
Rebar: 369.44 CY x 150 lb / CY = 55,416.66 lb @ $1.00 = $55,416.66

Micro Piles footing : 8 ft X 4.5 ft. X 3 ft. X 1/27 X38 CY X $1058 = $160,816.00
Rebar 152 CY X 150 lb X $1.00 = $22,800.00
Assume a $2,200 / Micro Pile X 10 piles per footing X 38 locations = $836,000

Total Cost: **$1,825,166.50**

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: D-3	**Sheet No.:** 1 of 5	**CREATIVE IDEA:** Construct the Courtland Bridge south of the CSX Railroad using Type III beams with three, 85-footspans.
Comp By: AS Date: 03/08/2011 Checked By: KB Date: 03/11/2011		

Original Concept:

The original design includes two long bridge spans between the south abutment and Pier 3 at the south side of the CSX Railroad crossing. The long spans (135 feet and 130 feet) require the use of large Bulb Tee 72-inch beams.

Proposed Change:

This recommendation revises the bridge spans between the south abutment and the original Pier 3 to provide three shorter (85-foot) spans thereby allowing the use of smaller Type III beams. This recommendation also relocates the south abutment from Station 13+25 to Station 13+35.

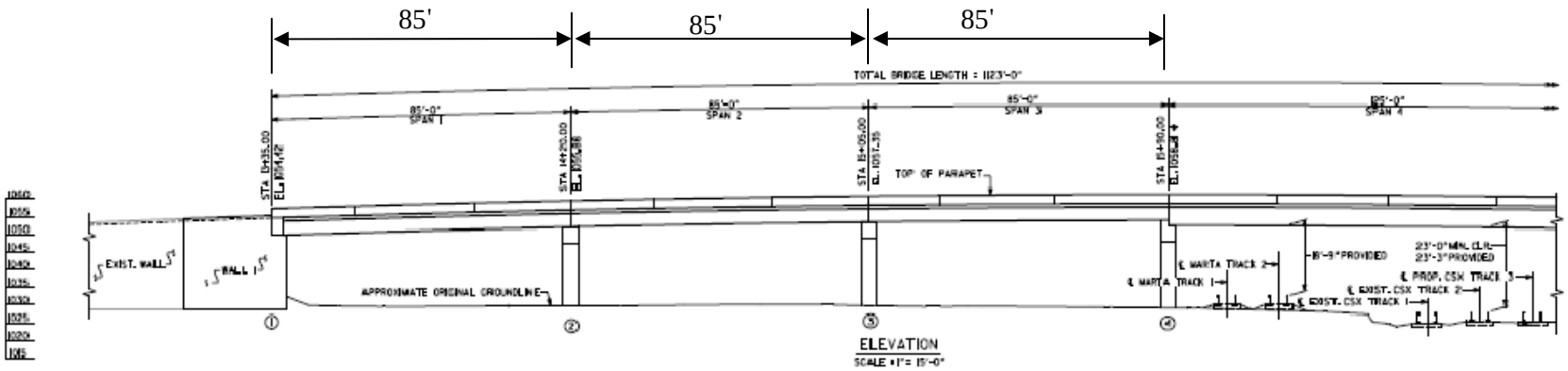
Justification:

The delivery, storage, and erection of the original design's large Bulb Tee 72-inch beams with 135 and 130-foot spans will likely require construction easements to store the beams and provide an area to setup the necessary construction equipment to erect them. This concept uses smaller Type III beams with shorter spans that likely can be stored and erected on site thereby simplifying construction and reducing cost. Using smaller Type III beams with shorter spans also reduces the size of the piers and caissons. This concept requires the south abutment (already being rebuilt) to be moved 10 feet to the north to reduce the proposed span lengths to 85 feet thereby allowing the use of Type III beams.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$968,000		
- Proposed	$800,000		
- Savings	$168,000		$168,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$168,000**

SKETCH	
Project: Courtland Street Bridge Replacement	Idea No.: D-3 Client: GDOT Sheet 2 of 5

Idea D-3 South Abutment to Station 15+90
Construct Using Type III Beams with 85-foot Spans
Requires 10-foot Northerly Shift of South Abutment



COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: D-3 Client: GDOT Sheet 3 of 5		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
BT 72-inch Beams	LF	2,084	$378.46	$788,710.64			
Center Pier for BT 72" Beams	LS	1	$179,245	$179,300.00			
VE Design:							
Type III Beams	LF				1,785	$283.78	$506,547.30
Small Piers for Type III Beams	LS				2	$142,500	$285,000.00
Additional Embankment	LS				1	$5,350	$5,350.00
Additional Pavement / Base	LS				1	$2,940	$2,940.00
Additional Sidewalk	LS				1	$407	$408.00
SUBTOTAL				$968,010.64			$800,245.30
TOTAL ROUNDED				**$968,000.00**			**$800,000.00**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-3 Client: GDOT Sheet 4 of 5

Bridge Pier Stationing Between CSX Railroad South Pier and South Abutment

Original Design	Station	Beam / Length	VE Design	Station	Beam / Length
South Abutment	**13+25**		South Abutment	**13+35**	
		BT 72 135 ft			Type III 85 ft
Pier 2	14+60		Pier 2A	14+20	
		BT 72 130 ft			Type III 85 ft
Pier 3	15+90		Pier 2B	15+05	
					Type III 85 ft
			Pier 3	15+90	

Revised Pier Spacing South of CSX South Railroad Pier

# Spans	Beam	Span	# Beams	Total Length	Cost / Foot	Total Cost
Original						
2	BT 72	135 / 130 ft	Plan Est.	2,084 ft	$378.46	$788,710.64
VE						
3	Type III	85 ft	7	1,785 ft	$283.78	$506,547.30

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-3 Client: GDOT Sheet 5 of 5

Original Design: 1 Large Center Pier for BT 72" Beams

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 4 ft diameter x 23 ft high x 2 column x 1 / 27 = 21.41 CY @ $1,058 = $22,651.78
Rebar: 52.81 CY x 150 lb / CY = 7,921.5 lb @ $1.00 = $7,921.50
Drilled 54" Caisson: 2 @ 30 ft @ $1,924 / ft = $115,440
Total Cost: $179,245.06 **USE $179,300**

VE Design: 2 Smaller Piers for Type III Beams

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 3 ft diameter x 23 ft high x 2 column x 1 / 27 = 12.04 CY @ $1,058 = $12,738.32
Rebar: 43.45 CY x 150 lb / CY = 6,517.5 lb @ $1.00 = $6,517.5
Drilled 42" Caisson: 2 @ 30 ft Assume a $1,500 / ft cost for 42" caisson = $90,000
Total Cost: $142,487.60 **USE $142,500**

Cost to Move Abutment 10 feet north:

MSE wall: 2 x 10 ft x 24 ft = 480 SF @ $58.36 = $28,012.8
Embankment: 10 ft x 24 ft x 60 ft = 14,400 / 27 = 533.33 CY Use 535 CY @ $10 = $5,350
Pavement: 10 ft x 44 ft = 440 / 9 = 48.88 SY Use 49 @ $60 = $2,940
Sidewalk: 10 ft x 7.5 ft x 2 = 150 /9 = 16.67 SY Use 17 @ $23.96 = $407.32

DEVELOPMENT AND RECOMMENDATION PHASE		
Project: Courtland Street Bridge Replacement		
IDEA No.: D-3.1	**Sheet No.:** 1 of 5	**CREATIVE IDEA: Alternative to D-3** Construct the Courtland Bridge south of the CSX Railroad using BT 54-inch beams with three shorter 88-footspans.
Comp By: AS Date: 03/08/2011 Checked By: KB Date: 03/11/2011		

Original Concept:

The original design includes two long bridge spans between the south abutment and Pier 3 at the south side of the CSX Railroad crossing. The long spans (135 feet and 130 feet) require the use of large Bulb Tee 72-inch beams.

Proposed Change:

This recommendation revises the bridge spans between the south abutment and the original Pier 3 to provide three shorter 88-foot spans thereby allowing the use of smaller Bulb Tee 54-inch beams. This recommendation also uses smaller piers.

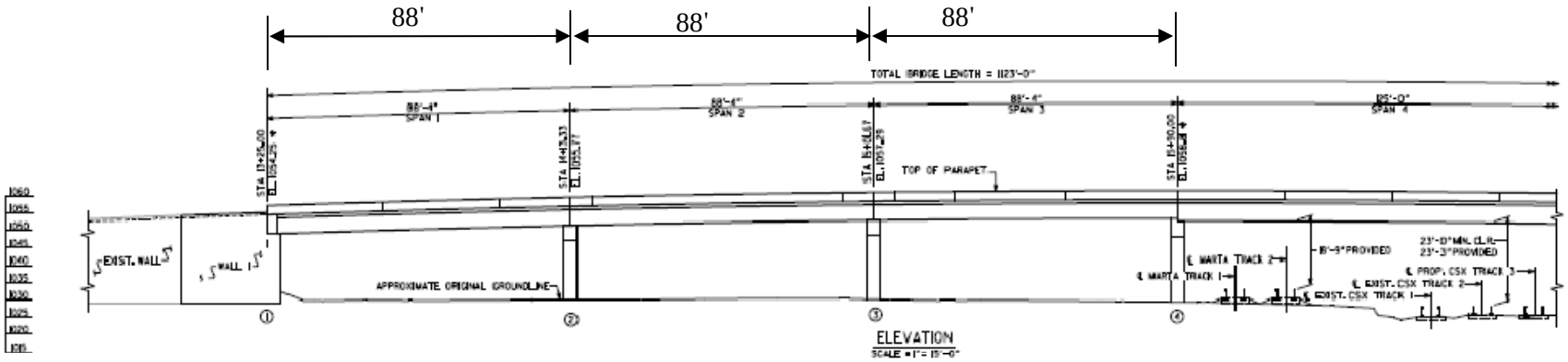
Justification:

The delivery, storage, and erection of the original design's large Bulb Tee 72-inch beams with 135 and 130-foot spans will likely require construction easements to store the beams and provide an area to setup the necessary construction equipment to erect them. This concept uses smaller Bulb Tee 54-inch beams with shorter (88-foot) spans that likely can be stored and erected on site thereby simplifying construction and reducing cost. Using smaller Bulb Tee 54-inch beams with shorter spans also reduces the size of the piers and caissons. This concept allows the south abutment (already being rebuilt) to remain in its proposed location.

LIFE CYCLE COST SUMMARY	CAPITAL COST	FUTURE COST	TOTAL COST
INITIAL COST: - Original	$968,000		
- Proposed	$951,000		
- Savings	$17,000		$17,000
FUTURE COST: – Savings		N/A	N/A
TOTAL PRESENT WORTH SAVINGS			**$17,000**

SKETCH	
Project: Courtland Street Bridge Replacement	Idea No.: D-3.1 Client: GDOT Sheet 2 of 5

Idea D-3 South Abutment to Station 15+90
Construct Using BT 54-inch Beams with 88-foot Spans
No Shift in South Abutment



COST WORKSHEET

Project: Courtland Street Bridge Replacement					Idea No.: D-3.1 Client: GDOT Sheet 3 of 5		
CONSTRUCTION ELEMENT		**ORIGINAL ESTIMATE**			**NEW ESTIMATE**		
Item	**Unit**	**No. Units**	**Cost/Unit**	**Total Cost**	**No. Units**	**Cost/Unit**	**Total Cost**
Original Design:							
BT 72-inch Beams	LF	2,084	$378.46	$788,710.64			
Center Pier for BT 72" Beams	LS	1	$179,245	$179,300.00			
VE Design:							
Bulb Tee 54-inch Beams	LF				1,848	$360.44	$666,093.12
Small Piers for Type III Beams	LS				2	$142,500	$285,000.00
SUBTOTAL				$968,010.64			$951,093.12
TOTAL ROUNDED				**$968,000.00**			**$951,000.00**

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-3.1 Client: GDOT Sheet 4 of 5

Bridge Pier Stationing Between CSX Railroad South Pier and South Abutment

Original Design	Station	Beam / Length	VE Design	Station	Beam / Length
South Abutment	**13+25**		South Abutment	**13+26**	
		BT 72 135 ft			B T 54-inch 88 ft
Pier 2	14+60		Pier 2A	14+14	
		BT 72 130 ft			BT 54-inch 88 ft
Pier 3	15+90		Pier 2B	15+02	
					BT 54-inch 88 ft
			Pier 3	15+90	

Revised Pier Spacing South of CSX South Railroad Pier

# Spans	Beam	Span	# Beams	Total Length	Cost / Foot	Total Cost
Original						
2	BT 72	135 / 130 ft	Plan Est.	2,084 ft	$378.46	$788,710.64
VE						
3	BT 54	88 ft	7	1,848 ft	$360.44	$666,093.12

CALCULATIONS	
Project: Courtland Street Bridge Replacement	Idea No.: D-3.1 Client: GDOT Sheet 5 of 5

Original Design: 1 Large Center Pier for BT 72" Beams

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 4 ft diameter x 23 ft high x 2 column x 1 / 27 = 21.41 CY @ $1,058 = $22,651.78
Rebar: 52.81 CY x 150 lb / CY = 7,921.5 lb @ $1.00 = $7,921.50
Drilled 54" Caisson: 2 @ 30 ft @ $1,924 / ft = $115,440
Total Cost: $179,245.06 **USE** **$179,300**

VE Design: 2 Smaller Piers for Type III Beams

Pier Cap: 4 ft x 4 ft x 53 ft long x 1 / 27 = 31.41 CY @ $1,058 = $33,231.78
Columns: 3 ft diameter x 23 ft high x 2 column x 1 / 27 = 12.04 CY @ $1,058 = $12,738.32
Rebar: 43.45 CY x 150 lb / CY = 6,517.5 lb @ $1.00 = $6,517.5
Drilled 42" Caisson: 2 @ 30 ft Assume a $1,500 / ft cost for 42" caisson = $90,000
Total Cost: $142,487.60 **USE** **$142,500**

APPENDIX

Sources

Approving/Authorizing Persons

Name:	Position:	Telephone:
Albert Shelby	Project Manager	404-631-1758
Ron Wishon	Project Review Engineer, Engineering Services	404-631-1753

Personal Contacts

Name:	Telephone:	Notes:
Albert Shelby	404-631-1758	Project Briefing
Sean Garland	770-200-1716	Project Briefing
Sean Garland	770-200-1716	Discuss Bridge Span Arrangements
Ted Cashin		Use of Class A concrete for sidewalks
William Luzier		Railroad Force Account

Documents/Abstracts

Reference:	Reference:
Preliminary Plans	Preliminary Boring Data
Preliminary Cost Estimate	Courtland Street Accident Data
1” = 20 Ft Aerial Layout Sketch of Courtland	Project Concept Report
1” = 20 Ft Aerial Sketch of Lower Collins St.	Pedestrian Access Points
Preliminary Environmental Document	Local Detour Route Options
Concept Photographs	Draft Pavement Evaluation Report

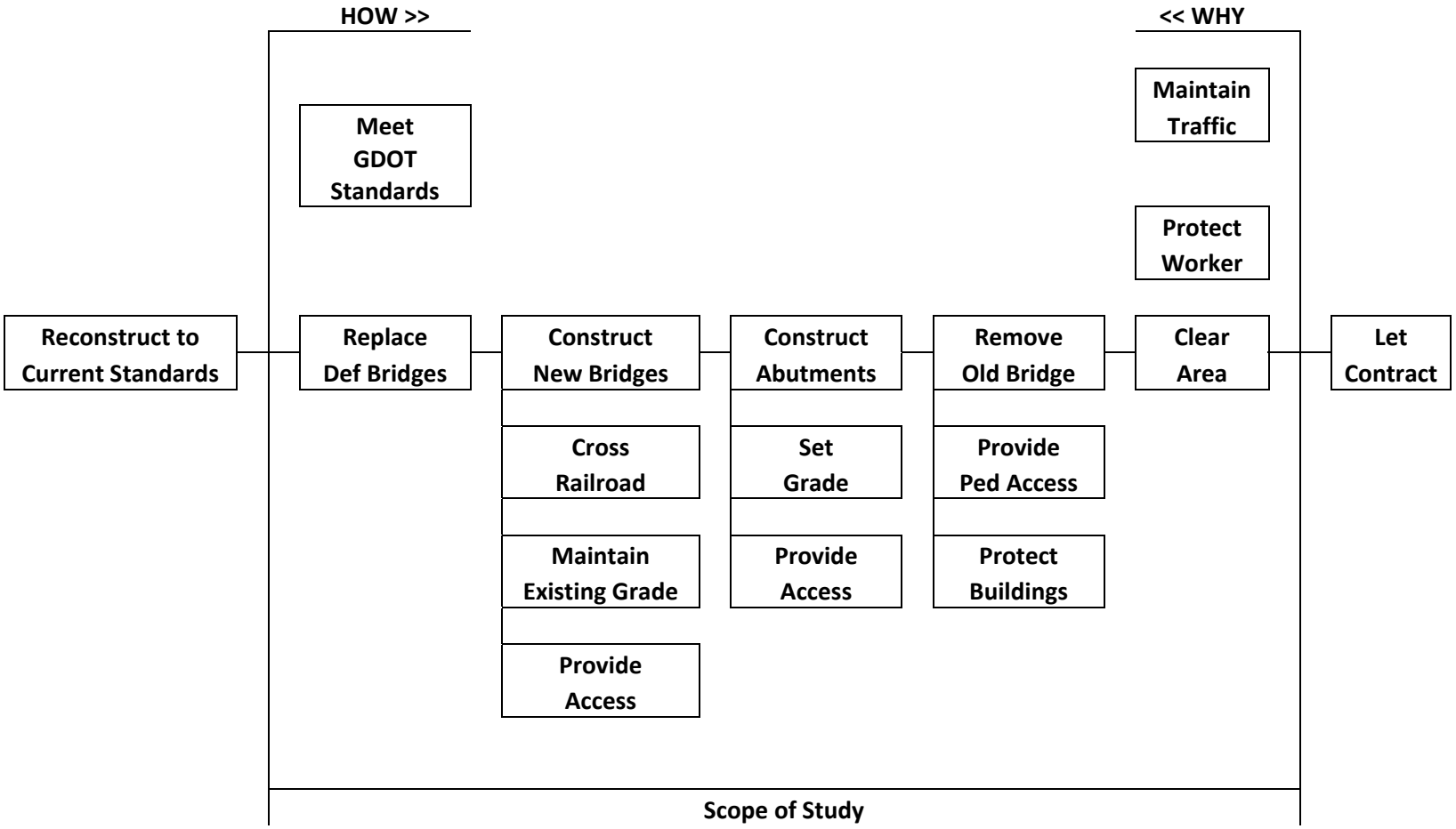
Courtland Street Bridge Replacement

Cost Model / Distribution

Item	Description	$ Amount	% of Total Project
A	Bridge Removal	$4,192,000	28.0%
B	Superstructure Concrete	$3,393,000	22.7%
C	Drilled Caisson	$1,205,000	8.0%
D	Bulb Tee 63 / 65-inch Beams	$1,084,000	7.2%
E	Class A Concrete	$871,000	5.8%
F	Bulb Tee 72-inch Beams	$789,000	5.3%
G	Superstructure Reinforcement Steel	$683,000	4.6%
H	Type III Beams	$531,000	3.5%
I	Traffic Control	$500,000	3.3%
J	Miscellaneous	$500,000	3.3%
K	Bulb Tee 54-inch Beams	$291,000	1.9%
L	Grading Complete	$260,000	1.7%
M	Type I Beams	$240,000	1.6%
N	Reinforcing Bars	$120,000	0.8%
O	MSE Walls & Additional Backfill	$110,000	0.7%
P	Bridge Excavation	$107,000	0.7%
Q	Concrete Sidewalk	$101,000	0.7%
		$14,977,000	

FAST DIAGRAM

Courtland Street Bridge replacement



INFORMATION PHASE – FUNCTION ANALYSIS

Project: Courtland Street Bridge Replacement
Function: Replace Bridge

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
A	**Bridge Removal**	Clear	Workspace	$4,192,000	28.0%	Yes
		Eliminate	Existing Bridge			
B	**Superstructure Concrete**	Provide	Road Surface	$3,393,000	22.7%	Yes
		Construct	Sidewalks			
		Provide	Safety Barrier			
		Construct	Bridge Deck			
		Provide	Veh/Ped Access			
		Protect	Brick Building			
C	**Drilled Caisson**	Support	Superstructure	$1,205,000	8.0%	Yes
		Establish	Grade			
		Transfer	Loads			
D	**Bulb Tee 63 / 65-inch Beams**	Support	Superstructure	$1,084,000	7.2%	Yes
		Span	Opening			
		Span	Railroads			
		Allow	Long Spans			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: Courtland Street Bridge Replacement
Function: Replace Bridge

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
E	**Class A Concrete**	Construct	Piers	$871,000	5.8%	Yes
F	**Bulb Tee 72-inch Beams**	Support	Superstructure	$789,000	5.3%	Yes
		Span	Long Areas			
		Minimize	Piers			
G	**Superstructure Steel**	Reinforce	Concrete	$683,000	4.6%	No
		Meet	Codes			
		Prevent	Cracking			
		Provide	Strength			
H	**Type III Beams**	Support	Superstructure	$531,000	3.5%	Yes
		Allow	Shorter Spans			
		Reduce	Weight			
I	**Traffic Control**	Close	Road	$500,000	3.3%	Yes
		Redirect	Pedestrians			
		Sign	Detour			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: Courtland Street Bridge Replacement
Function: Replace Bridge

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
J	**Miscellaneous**	Complete	Construction	$500,000	3.3%	No
K	**Bulb Tee 54-inch Beams**	Support	Superstructures	$291,000	1.9%	Yes
		Reduce	Span Length			
L	**Grading Complete**	Modify	Embankment	$260,000	1.7%	No
M	**Type I Beams**	Support	Superstructure	$240,000	1.6%	Yes
		Minimize	Span Length			
		Reduce	Weight			
		Minimize	Clearance			
N	**Reinforcing Steel**	Strengthen	Columns	$120,000	0.8%	No
O	**MSE Walls & Backfill**	Modify	Abutments	$110,000	0.7%	Yes
		Hold	Embankment			
		Supplemental	Existing Walls			

INFORMATION PHASE – FUNCTION ANALYSIS

Project: Courtland Street Bridge Replacement
Function: Replace Bridge

ITEM No.	DESCRIPTION	FUNCTION		INITIAL DOLLARS		
		Verb	Noun	Cost	% of Total	Worth/Save
P	**Bridge Excavation**	Clear	Footing Area	$107,000	0.7%	No
Q	**Concrete Sidewalk**	Replace	Existing	$101,000	0.7%	No

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
A	**Bridge Removal**		
A-1	Salvage the Decatur Street Bridge and incorporate it into the new structure.	Against GDOT policy	X
A-2	Salvage the steel from the old bridge and sell it for scrap.	Not a GDOT practice, Contractor salvages steel	X
A-3	Salvage the steel from the old bridge and use it in the new structure.	Not a GDOT Practice, Higher maintenance cost	X
A-4	Leave the existing pier in the center of the railroad area since it doesn't impact train operation.	Eliminate cost to remove pier, Eliminate need for associated RR Force Account work	✓
A-5	Reuse the newer large pier just north of the CSX railroad.	Reduce cost	✓
A-6	Replace the entire bridge deck but keep some / all of the old bridge substructure.	Accelerate construction, Allow work to proceed under existing bridge deck, Reduce cost	✓
A-7	Establish a cost for the Railroad Force Account needed to work in and around the active railroad tracks.	Railroad Force Account cost need to be added to the project cost estimate	DS
A-8	Establish a method to accommodate pedestrian traffic during the removal of the old bridge and construction of the new bridge.	Heave pedestrian traffic from the university cross under and over the bridge and need to be addressed.	✓
A-9	Don't remove the northern four spans of the existing bridge until the end of construction to facilitate pedestrians.	Address in the construction staging plans and with the university prior to letting contract	DS
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
B	**Superstructure Concrete**		
B-1	Use a different class of concrete for the sidewalk on the new bridge.	Reduce cost	✓
B-2	Eliminate the proposed parapet alongside buildings.	Reduce cost, No parapets at other buildings	✓
B-3	Construct parapet walls alongside all of the buildings.	Higher cost, Need not established	X
C	**Drilled Caisson**		
C-1	Eliminate the proposed caissons at Decatur Street by reusing the existing piers / caissons at Decatur Street.	Reduce cost, speed construction, Question if GDOT policy would allow concept	✓
C-2	Eliminate the proposed caissons and reuse the existing piers / caissons at the large pier at Station 37+40.	Question if GDOT policy would allow concept	X
C-3	Construct the new bridge using shorter spans thereby reducing the size of the piers and caissons.	Reduce cost, Simplify construction in the confined area between the various buildings	✓
C-4	Use Micro Piles in-lieu-of Caissons.	Reduce cost, Allows work under existing deck	✓
C-5	Reuse / Modify the existing piers and footings.	Reduce cost, Allows work under existing deck	✓
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
D	**Bulb Tee 63 / 65-inch Beams**		
D-1	Use steel beams in-lieu-of BT 65-inch beams over the railroad tracks.	Simpler to work with than large / heavy concrete beams, Simplify work over railroad	✓
D-2	Construct the part of the bridge north of the CSX Railroad tracks using Type III Beams with 81-foot spans.	Reduce beam size, Simplify construction between buildings, Reduce cost	✓
D-2.1	Construct the part of the bridge north of the CSX Railroad tracks using piers parallel to the roadway and Type II beams perpendicular to the roadway.	Reduce beam size, Simplify construction between buildings, Reduce cost	✓
D-3	Construct the part of the bridge south of the CSX Railroad tracks using Type III Beams with 85-foot spans.	Reduce beam size, Simplify construction between buildings, Reduce cost	✓
E	**Class A Concrete**		
E-1	Construct the sidewalks on the bridge using Class A Concrete.	See Idea B-1	X
E-2	Use Class A concrete for piers and caps.	Standard practice is to us Class AA concrete	X
F	**Bulb Tee 72-inch Beams**		
F-1	Replace with Type III beams with shorter spans.	Reduce cost, Simplify construction	✓
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

CREATIVE PHASE Creative Idea Listing		JUDGMENT PHASE Idea Evaluation	
No.	**CREATIVE IDEA**	**COMMENTS**	**IDEA RATING**
H	**Type III Beams**		
H-1	Construct the entire structure using Type III beams and shorter span lengths (80 – 85 feet).	See Ideas D-3 and F-1	X
I	**Traffic Control**		
I-1	Add a railroad Force Account Cost to the project estimate.	See Idea A-7	X
K	**Bulb tee 54-inch Beams**		
K-1	Shift Pier 5 closer to Pier 4 to reduce the span length to allow the use of smaller Type III beams.	See Idea D-2	X
M	**Type I Beams**		
M-1	Lengthen the spans and us Type III beams thereby eliminating a pier.	See Idea D-2	X
✓ = Will be considered further; X = will be dropped; DS = Design suggestion –written for consideration by design team			

VE STUDY SIGN-IN SHEET

Project No.: BRMLB-9007-00(014) County: Fulton PI No.: 752015- Date: March 7-10, 2011

Days FIRST	Days LAST	NAME	EMPLOYEE ID NO.	DOT OFFICE OR COMPANY	PHONE NUMBER	EMAIL ADDRESS
✓	✓	Lisa L. Myers		Engineering Services	404-631-1770	lmyers@dot.ga.gov
✓	✓	Matt Sanders		Engineering Services	404-631-1752	msanders@dot.ga.gov
O	O					
✓	O	Ken Werho		Traffic Operations	404-635-8144	kwerho@dot.ga.gov
✓	✓	Ron Wishon		Engineering Services	404-631-1753	rwishon@dot.ga.gov
✓	✓	Bill DuVall		Bridge Design	404-631-1883	bduvall@dot.ga.gov
✓	✓	Keith Borkenhagen		MACTEC	623-556-1875	kborkenhagen@msn.com
✓	✓	Mindy Sanders		HMM	770-200-1710	mhsanders@hatchmott.com
✓	✓	GEORGE OBARANEZ		MACTEC	770 421 3346	GAOBARANEZ@MACTEC.COM
✓	✓	Anna Sastry		SASTRY AND ASSOC	678-366-9375	sast9375@bellsouth.net
✓	O	Sean Garland		HMM	770-200-1716	sean.garland@hatchmott.com
✓	✓	Steven Gaines		Wolverton & Assoc	770-447-8889	steven.gaines@wolverton-assoc.com
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✓	O	Emory Harris		Construction	770-861-9238	EHarris@dot.ga.gov
✓	O	Samuel Williams		Construction	912-424-9338	Sawilliams@dot.ga.gov
✓	✓	Albert Shelby		Program Delivery	404-631-1758	ashelby@dot.ga.gov
✓	O	STANLEY HILL		Program Delivery	404-631-1560	SHill@dot.ga.gov

✓ Check all that attend O = Did not Attend 17 Attended Project Overview(Day 1) 10 Attended Project Presentation (Day 4)